भारतीय मानक
Indian Standard

IS 1956 (Part 3) : 2019

लौह एवं इस्पात की परिभाषिक शब्दावली

भाग 3 लम्बवत् उत्पाद (सलाखों, छड़े, वर्गों और तारों सहित)

(दूसरा पुनरीक्षण)

Glossary of Terms Relating to Iron and Steel

Part 3 Long Products (Including Bars, Rods, Sections and Wires)

(Second Revision)

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FOREWORD

This Indian Standard (Part 3) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1962 and subsequently revised in 1975. While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise it to bring in line with the present practices being followed by the Indian industry and corresponding International standards on terminology.

In this revision the following changes have been made:

a) All the 3 amendments have been incorporated.

b) The requirements of IS 1956 (Part 5) : 1976 'Glossary of terms relating to iron and steel : Part 5 Bright steel bar and steel wire (*first revision*)' have been incorporated in the standard.

c) Clauses **2.2** and **2.3** covers product related definitions, clause **2.4** covers process related definitions and clause **2.5** covers defects related definitions.

The revised standard shall supersede IS 1956 (Part 5) : 1976.

This standard is published in eight parts. The other parts in the series are:

Part 1	General metallurgy, heat treatment and testing
Part 2	Steel making
Part 4	Flat products
Part 6	Forging (including drop forging)
Part 7	Wrought iron
Part 8	Steel tubes and pipes

In the formulation of this standard assistance has been derived from the following publications:

ISO 6929 : 1987	Steel products — Definitions and classifications
BS EN 10079 : 2007	Definitions of steel products

Indian Standard

GLOSSARY OF TERMS RELATING TO IRON AND STEEL

PART 3 LONG PRODUCTS (INCLUDING BARS, RODS, SECTIONS AND WIRES)

(Second Revision)

1 SCOPE

This standard (Part 3) defines terms for steel products according to,

a) stage of manufacture;
b) their shape and dimensions; and
c) their appearance and surface condition.

NOTES

1 Although the products are generally defined independently of their end uses or manufacturing processes, it has sometimes been necessary to make reference to these criteria.

2 All dimensions given in this standard are nominal.

2 TERMS AND DEFINITIONS

For the purpose of this standard the following terms and definitions shall apply.

2.1 Liquid Steel — Steel in the liquid state ready for pouring and obtained from the melting of raw materials.

2.2 Ingot and Semi-Finished Products

2.2.1 *Ingot* **—** Products obtained by pouring liquid steel into moulds of a shape appropriate to the subsequent processing into semi-finished products, or flat or long products, generally by hot rolling or forging.

NOTES

1 The shape generally resembles a truncated pyramid or truncated cone; the side surfaces may be corrugated and the corners more or less rounded. Depending on subsequent conversion requirements, ingots may be dressed and/or hot scarfed or cropped without altering their status as 'ingots'.

2 According to the cross-section, a distinction is made between the following:

a) Ingots, having a cross-section that may be square, rectangular (of width up to twice the thickness), polygonal, round, oval or shaped according to the profile to be rolled; and
b) Slab ingots, of rectangular cross-section of width twice the thickness or over.

2.2.2 *Semi-finished Products* — Continuously cast products and products generally obtained by forging or rolling ingots and intended for transformation into finished products. The cross-section is generally square, rectangular with angles more or less rounded; the section has uniform dimension all along the length of the piece. The tolerances are generally wider than those for finished products. The surfaces can be partially or totally conditioned by scarfing, chipping, grinding, planning or milling and turning.

2.2.2.1 *Semi-finished products of square cross-section* **—** Semi-finished products with sides of 50 mm or over, generally described as blooms, if the sides are greater than 200 mm or as billets, if smaller.

NOTE — These dimensions may be less for certain types of steel, for example high-speed steels.

2.2.2.2 *Semi-finished products of rectangular cross-section* **—** Semi-finished product of cross-sectional area of 2 500 mm^2 or over of width up to twice the thickness, generally described as blooms, if the cross-sectional area is greater than 40 000 mm^2 or as billets, if smaller.

2.2.2.2.1 Slab — A semi-finished product of rectangular cross-section with a thickness of at least 50 mm and a width of at least twice the thickness, described as a slab.

2.2.2.2.2 *Sheet bar (Slab bars)* — Semi-finished products of rectangular section, of a thickness not less than 6 mm, width not less than 150 mm and of such dimensions that the thickness does not exceed one quarter of the width. This product also includes the product tinplate bars.

2.2.2.2.3 *Tin Bar* — A type of bar suitable for rolling tin plate.

2.2.2.2.4 *Sheet Slab* — A slab of suitable size for rolling into sheet.

2.2.2.3 *Round semi-finished products* **—** Continuously cast or forged semi-finished products of circular cross-section.

2.2.2.4 *Blank for sections* — Semi-finished products intended for the manufacture of specific sections that have been preformed for that purpose.

NOTE —The cross-sectional area is generally over 2 500 mm^2.

2.2.2.5 *Blank for tubes and pipes* — Semi-finished product, usually shaped as round bars, intended for the manufacture of tubes and pipes that have been preformed for that purpose.

2.2.2.6 *VAR ingot* — Semi-finished product, usually shaped as round ingots or blooms, obtained by melting press-formed metallic raw material or by remelting ingots or blooms using a vacuum arc remelting (VAR) furnace

NOTE —Vacuum arc remelting results in products with improved chemical homogeneity and inclusion cleanliness.

2.2.2.7 *ESR ingot* — Semi-finished product, usually shaped as round ingots or blooms, obtained by melting press-formed metallic raw material or by remelting ingots or blooms using an electro slag remelting (ESR) furnace.

NOTE — Use of electro slag remelting results in products with improved chemical homogeneity and inclusion cleanliness.

2.3 Long Products

2.3.1 *General* — Long products have a constant cross-section that is usually defined by a standard that establishes the normal size ranges and the tolerances on shape and dimensions. The surface is generally smooth, but in certain cases, for example reinforcing bars, may have a regularly raised or indented pattern.

2.3.2 *Rod* — Hot rolled long product having a nominal size generally 5 mm or above and wound into irregular coils.

NOTE — The cross-section may be round, oval, square, rectangular, hexagonal, octagonal, half-round or of any similar shape. Its surface is smooth. Rod is generally intended to undergo further processing. It may also be used, with or without further processing, for example cold deforming, for the fabrication of welded mesh or for other elements used to reinforce concrete.

2.3.2.1 *Wire rod* — Rod in the coiled form generally intended for conversion into wire.

2.3.3 *Wire* — Product of constant full cross-section along its length, obtained by cold drawing rod through a reducing die or passing under pressure between rollers and rewinding the drawn product.

NOTES

1 A product in coil form obtained from wire rod, generally in round, half round, square, hexagonal, flat or of any other section including grooved section, characterized by the fact that it has been subjected to cold drawing through a die or by other mechanical means. It is usually more severely cold drawn than bright bars.

2 The manufacturing processes give close control of geometric (size, surface condition) and mechanical properties. Wire may be supplied uncoated (as drawn, annealed) or coated (for example with zinc, copper, nickel or plastic materials).

3 Heat treatments and/or surface treatments may be carried out during the course of manufacture to improve the properties of wire.

2.3.3.1 *Annealed, cleaned and limed wire* — Annealed wire, pickled to remove scale, washed in water, dipped in hot lime water and dried.

2.3.3.2 *Bench drawn (Rack drawn)* — Bars bright drawn in straight lengths on a draw bench.

2.3.3.3 *Best patented steel wire* — Rope wire drawn to tensile strength of 1 255 to 1 460 N/mm^2 (128 to 147 kgf/mm^2).

2.3.3.4 *Best plough steel wire* — Patented rope wiredrawn to tensile strength of 1 520 to 1 655 N/mm^2 (155 to 170 kgf/ mm^2).

2.3.3.5 *Binders (Bands, tie wires)* — Soft wires used for tying bundles or coils of wire.

2.3.3.6 *Black annealed wire* — Wires annealed without protective atmosphere.

2.3.3.7 *Block drawn* — Wire drawn in coil on a block.

2.3.3.8 *Blue annealed wire (Turned bar)* — Wire with a scale-free surface, but oxidized to a blue temper colour during annealing.

2.3.3.9 *Bright annealed wire (White annealed wire)* — Wire which has been annealed in a controlled atmosphere to prevent surface oxidation.

2.3.3.10 *Bundle* — Two or more coils or a number of lengths securely bound together.

2.3.3.11 *Cast (of Wire)* — The behaviour of waps of wire in a coil.

2.3.3.12 *Bad cast* — A coil in which the waps when released do not conform to the desired shape.

2.3.3.12.1 *Dead cast* — A coil in which the wire lies in circles of uniform diameter.

2.3.3.12.2 *Helical cast* — A coil in which the wire tend to spring out from the coil in spirals.

2.3.3.12.3 *Straight cast* — A coil in which the wire when unwound will run out approximately straight.

2.3.3.13 *Catchweight coil* — A coil of non-standard weight.

2.3.3.14 *Chilled spring wire* — Wire drawn from quenched and age hardened mild steel.

2.3.3.15 *Coppered wire* — A wire produced by wet drawing with a copper sulphate or copper tin sulphate solution for improving drawability. The colour depends upon the chemicals used and the drawing operation imparts a lustre to the wire, resulting in improved appearance and a limited amount of corrosion resistance.

2.3.3.16 *Drawn coppered wire* — Wire coppered at the base size and drawn to the final size.

2.3.3.17 *Drawn galvanized wire* — Wire galvanized at the base size and drawn to the final size.

2.3.3.18 *Drawn tinned wire* — Wire tinned at the base size and drawn to the final size

2.3.3.19 *Hard-drawn wire* — Wire drawn with a relatively large reduction from the rod heat treatment.

2.3.3.20 *Inter annealed wire* — Wire drawn to an intermediate stage, annealed and drawn to the size required.

2.3.3.21 *Length* — A straight piece of wire or bar cut to a specified or random length.

2.3.3.22 *Mild-drawn wire (Soft-drawn wire)* — Wire drawn from the rod or annealed base with a reduction in area of less than 10 percent.

2.3.3.23 *Multiple lengths* — Length from which a given number of pieces of specified lengths can be cut with minimum waste.

2.3.3.24 *Oil-hardened and tempered wire* — Wires that are heat treated in the following way: they are first transformed into austenite, quenched in oil or other suitable medium and then tempered at an appropriate temperature.

2.3.3.25 *Patented cold-drawn steel wire* — Wire drawn to intermediate size by cold deformation of a starting material that has been subjected to a thermal treatment of patenting.

2.3.3.26 *Piano wire (Music wire)* — A very high quality high carbon (usually 0.80 to 0.95 percent), patented drawn and polished wire having a tensile strength in excess of 1 865 N/ mm^2 (190 kgf/mm^2) and generally in sizes of 1.6 mm and finer. The term music wire also includes wire intended for mandolins.

2.3.3.27 *Plough steel wire*

2.3.3.27.1 *Best plough steel wire* — Patented rope wire drawn to a tensile strength of 1 570 to 1 655 N/mm^2 (155 to 170 kgf/mm^2).

2.3.3.27.2 *Special improved plough steel wire* — Patented rope wire drawn to a tensile strength of 1 665 to 1 815 N/mm^2 (170 to 185 kgf/ mm^2).

2.3.3.27.3 *Extra special improved plough steel wire* — Patented rope wire drawn to a tensile strength of 1 765 to 1 910N/mm^2 (180 to 195 kgf/mm^2).

2.3.3.28 *Soap-drawn wire* — A wire drawn to the finished size using soap as lubricant.

2.3.3.29 *Tinned wire* — Finished wire tinned by electrotinning or hot dip tinning process.

2.3.3.30 *Wet-drawn wire (Lacquer-drawn wire)* — A wire passing through a liquid lubricant. This imparts a bright surface to the wire.

2.3.3.31 *Wiped galvanized wire* — Wire that has been hot dip galvanized and drawn through liquid suitable wipers while the zinc is in the molten state. The term is also applied to electrogalvanized wire of uniform coating.

2.3.4 *Hot-finished bars* — Product supplied in straight lengths but not in coils, thus differentiating them from rod.

2.3.4.1 *Hot rolled bars* — Hot rolled products in straight lengths of constant transverse section having a solid (convex) cross-section as defined in **2.3.4.1.1** to **2.3.4.1.4**.

2.3.4.1.1 *Rounds* — Bars having a circular cross-section of diameter generally 8 mm or above.

2.3.4.1.2 *Square, hexagon and octagon bar* — Bars having a square, hexagonal or octagonal cross-section; the side is generally 8 mm or over for squares, or 13 mm or over for hexagons.

NOTE — Squares of sides up to 50 mm with rounded corners are considered to be square bars.

2.3.4.1.3 *Flat bar* — Bars of rectangular cross-section rolled on the four faces of thickness generally 5 mm or above and with a width not over 150 mm.

2.3.4.1.4 *Bars of special shape* — Products hot rolled in lengths of particular full cross-sectional shapes including in particular trapezoids, bevels, triangles, bars for grooved springs, semi-rounds and half flat semi-rounds such as BULB BAR / Z bar.

2.3.4.2 *Forged bars* — Products obtained by forging and that do not undergo subsequent hot conversion.

NOTE — These products are mainly in the form of rounds or squares.

2.3.4.3 *Hollow mining drill bar* — Bar with an internal hollow of any cross-sectional shape, suitable for the manufacture of drill bits, with an external cross-sectional dimension over 15 mm up to and including 52 mm that is at least twice the maximum dimension of the cross-section of the internal hollow.

2.3.5 *Bright Bar* — Round bar of various cross-sectional shapes obtained by drawing or turning

2.3.5.1 *Drawn product* — Products of various cross-sectional shapes obtained by drawing of hot rolled bars or rod, on a draw bench (cold deformation without removing material), after descaling.

NOTE — This operation gives the product special features with respect to shape, dimensional accuracy and surface finish. In addition, the process causes cold working of the product that can be eliminated by subsequent heat treatment. Products in lengths are delivered straightened regardless of size.

2.3.5.2 *Turned product* — Round bars produced by turning on a lathe where the product can be further processed by straightening and polishing.

NOTES

1 This operation gives the bar special features with respect to shape, dimensional accuracy and surface finish. The removal of metal is carried out in such a way that the bright product is generally free from rolling defects and surface decarburization.

2 For technical reasons, some bars ordered as hot rolled products may be delivered roughly turned (peeled); nevertheless, such products are treated as hot rolled products and not bright products.

2.3.5.3 *Ground product* — Drawn or turned round bars given an improved surface quality and dimensional accuracy by grinding or grinding and polishing.

2.3.6 *Deformed product for reinforcement and prestressing of concrete* — Products with a cross-section that is round or almost round, with crenelated or ribbed surfaces, for reinforcement and prestressing of concrete and supplied in the forms defined in **2.3.2**, **2.3.3** and **2.3.4.**

NOTE — These bars may, after hot rolling, have undergone a controlled cold deformation, for example lengthening or twisting about their longitudinal axis.

2.3.7 *Hot rolled section* — Product of various cross-sectional shapes obtained by hot rolling.

2.3.7.1 *Railway material* — Product used in the construction of railway tracks and other systems of rails.

2.3.7.1.1 *Railway track product* — Hot rolled railway products as follows:

a) *Heavy railway products*
   1) Rails of linear mass 20 kg/m or over (except those in **2.3.7.1.2**); and
   2) Sleepers of linear mass 15 kg/m or over.

   NOTE — The purpose of steel rails is to form a continuous runway or track, which has sufficient strength for carrying, required moving wheel loads. Rails are now designed with a head for wheel treads and for guiding the wheels flange a web for girder strength and fastening the rail to its support. A proper proportioning of the head, web and base in section design is an important consideration in the manufacture of the rails as well as in their efficient utility.

b) *Light railway product* — Railway product including,
   1) rails of linear mass up to 20 kg/m except those in **2.3.7.1.2**;
   2) sleepers of linear mass up to 15 kg/m;
   3) conductor rails with specified electrical resistivity properties;
   4) rails for switches and crossings;
   5) guide rails;
   6) brake rails;
   7) fish plates; and
   8) base plates (also known as sole, tie or bearing plates).

c) *Products for other rail systems* — Hot rolled products for other rail systems as follows:
   1) Crane rails; and
   2) Grooved rails.

2.3.7.2 *Piling* — Product used for piling.

NOTE —According to the product shape and application, products are classified in **2.3.7.2.1** to **2.3.7.2.3**.

2.3.7.2.1 *Sheet piling* — Product obtained by hot rolling or cold forming (drawing, bending, roll forming, etc) to a shape such that, by interlocking of the joints or by fitting of longitudinal grooves or by means of special fasteners, it forms partitions or continuous walls.

NOTE — Sheet piling is distinguished according to its form in cross-section and its application; *See* Fig. 1A, Fig. 1B, Fig 1C for examples.

a) C, U and Z sheet piling;
b) Straight web or flat sheet piling;
c) Fabricated sheet piling;
d) Boxed piles: fabricated from U or Z sheet piles and steel plates;
e) Combined walls:
   1) Interlocking H-sheet piling;
   2) H-piles with intermediary Z-sheet piling;
   3) Interlocking tubular piles;
   4) Tubular piles with intermediate sheet piling; and
   5) Combined walls using boxed piles.
f) Cold formed sheet piling:
   1) Sheet piling Ω (Omega) and Z; and
   2) Trench sheeting.
g) Corner sections.

2.3.7.2.2 *Fabricated bearing piling* — Fabricated piling, made up from steel elements and used for bearing purposes.

NOTE — Boxed piles may be used as fabricated bearing piling.

2.3.7.2.3 *Tubular fabricated bearing piling* — Tube or circular, square or rectangular cross-section, driven into the ground to transmit the weight of structures to the soil by resistance developed at its base and by friction along its surface.

NOTE — The terms sheet piling and bearing piling include piling that has undergone certain finishing operations such as piercing or welding of attachments.

2.3.7.3 *Mining frame sections* — Products with cross-sections resembling the letter I or the Greek capital letter Omega (Ω).

NOTE — Mining frame I sections are distinguished from other I sections by a greater slope of the inside face of the flanges. Generally, they also have a flange width over 0.70 of the nominal web height (*see* Fig. 2).

2.3.7.4 *Heavy section* — Hot rolled product with cross-section resembling the letter I, H or U (*see* Fig. 3).

NOTES

1 They have the following characteristics:

a) Web height of 80 mm or over;
b) Surfaces of the webs are continued by fillets to the inside faces of the flange;
c) Flanges are generally symmetrical and of equal widths (*see also* **2.3.7.4.5**);
d) Outside faces of the flanges are parallel; and

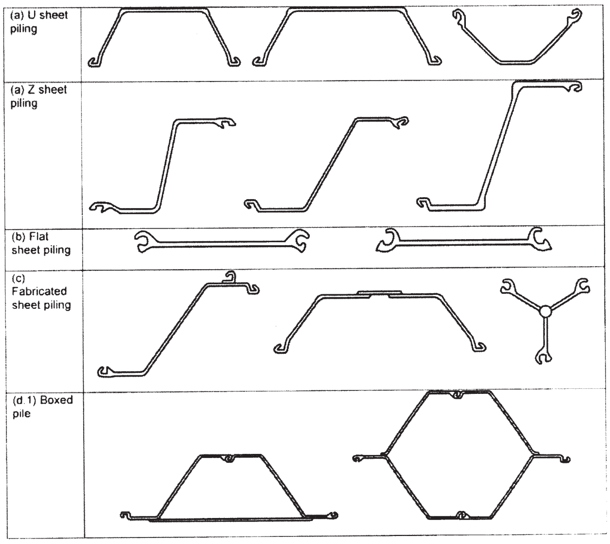

FIG. 1A ILLUSTRATIONS OF TYPICAL SHEET PILING

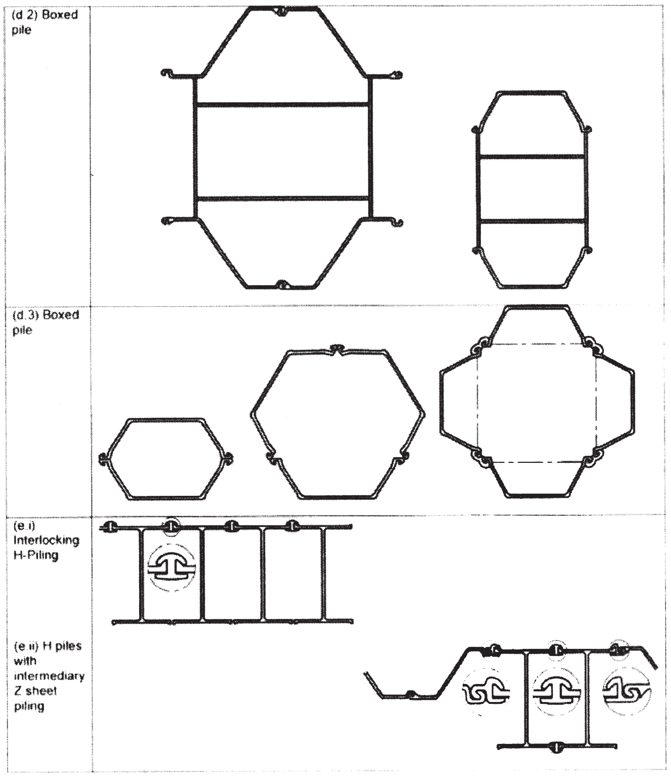
(d 2) Boxed pile
(d.3) Boxed pile
(e i) Interlocking H-Piling
(e ii) H piles with intermediary Z sheet piling

FIG. 1B ILLUSTRATIONS OF TYPICAL SHEET PILING

e) Flanges are either of decreasing thickness from the web to the edge ('tapered flanged'), or of uniform thickness ('parallel flanged').

2 A distinction is made between:

a) *Parent sections* — Sections with web and flange thickness considered as standard.

b) *Thin sections* — Sections manufactured with the same series of rolls as used in producing the corresponding parent section but which, for an approximately equal web height, have thinner web and/or flanges (as a result of adjustment of the vertical or horizontal rolls).

c) *Thick sections* — Sections manufactured with the same series of rolls as used in producing the corresponding parent section but which, for an approximately equal web height, have a thicker web and/or flanges (as a result of adjustment of the vertical or horizontal rolls).

2.3.7.4.1 *I sections (narrow and medium flanges)* — Sections having a cross-sectional shape resembling the letter I where the flange are not wider than 0.66 of the nominal height of the section and less than 300 mm.

2.3.7.4.2 *H sections (wide flanged beams)* — Sections having a cross-sectional shape resembling the letter H where the flange are wider than 0.66 of the nominal

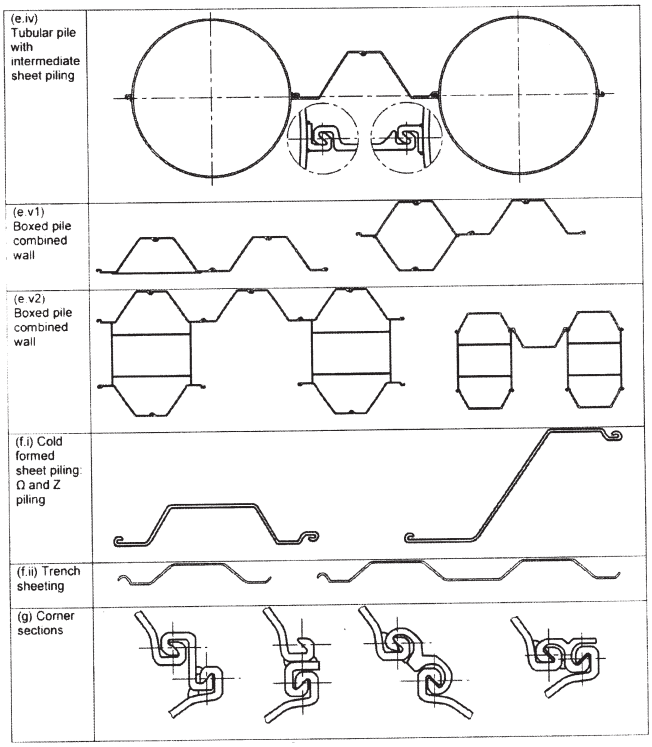
(e.iv) Tubular pile with intermediate sheet piling
(e.v1) Boxed pile combined wall
(e.v2) Boxed pile combined wall
(f.i) Cold formed sheet piling: Ω and Z piling
(f.ii) Trench sheeting
(g) Corner sections

FIG. 1C ILLUSTRATIONS OF TYPICAL SHEET PILING

height of 300 mm or over. Sections with flanges wider than 0.8 of the nominal height are sometimes called 'columns'.

2.3.7.4.3 *U sections (channels)* — Sections having a cross-sectional shape resembling the letter U.

NOTE — In the standardized series the flanges have a maximum width of (h/2 + 25) mm where h is the overall height including the flanges.

2.3.7.4.4 *Bearing piles* — Sections having a cross-sectional shape resembling the letters H or I where the thicknesses of the web and flanges are identical.

NOTE — Bearing piles may also be equipped with laggings (enlargements along the length of the pile or at its bottom).

2.3.7.4.5 *Special heavy sections* — Sections having I, H, U or similar cross-sectional shapes with a web height of 80 mm or above but with features such as unequal or asymmetric flanges or non-standard web thickness.

NOTE — These products are generally manufactured in limited quantities.

2.3.7.5 *Other sections*

2.3.7.5.1 *Small U, I and H sections* — Sections having a cross-section resembling the letters U, I or H and where the web height is less than 80 mm (*see* Fig. 3).

2.3.7.5.2 *Angles* — Sections having a cross-section resembling the letter L.

NOTE — Angles can be defined as equal or unequal angles depending on the ratio of the flange widths. The corners of the flanges are rounded.

2.3.7.5.3 *T sections with equal flanges* — Sections having a cross-section resembling the letter T, where the corners are rounded, and the flanges and web are slightly tapered, and where the flanges are of equal width**.**

NOTE — T Sections can also be fabricated from H Sections that are split along the web. These have parallel web and flange profiles.

2.3.7.5.4 *Bulb flats* — Generally rectangular cross-sectional shapes with a bulge along the full length of a longitudinal edge of one of the wider surfaces and a width generally up to 430 mm.

2.3.7.5.5 *Special sections* — Products hot rolled in lengths usually of small open cross-section or of very special shape that are generally rolled in limited quantities, and are not covered by **2.3.7.4** or **2.3.7.5.1** to **2.3.7.5.4**.

NOTES

1 This class includes in particular Z sections, T sections with unequal flanges, square-edged L, U and T sections, track shoe sections, etc.

2 These sections may also be obtained by hot extrusion.

2.3.8 *Welded Sections* — Long products of open cross-sections that have cross-sectional shapes similar to the products defined in **2.3.7.4** and **2.3.7.5**, but instead of being obtained directly by hot rolling, are made up by

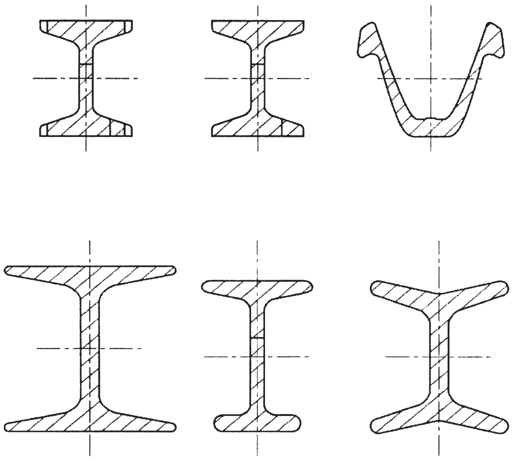

FIG. 2 ILLUSTRATIONS OF TYPICAL MINING FRAME SECTIONS

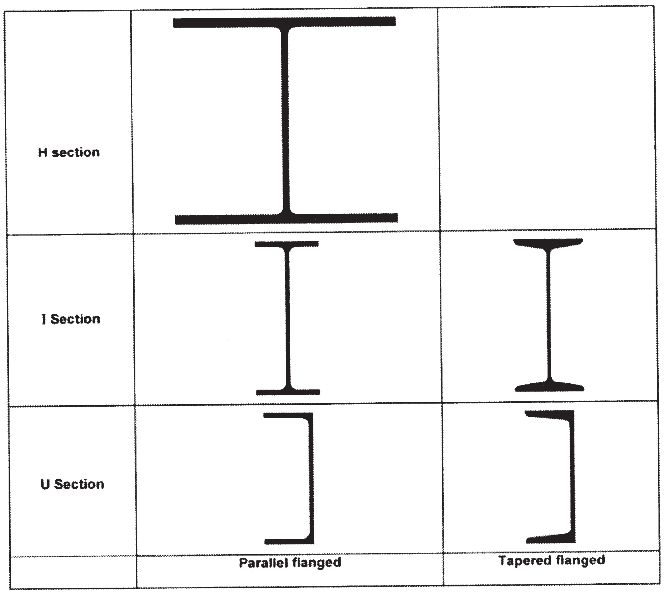

FIG. 3 ILLUSTRATIONS OF TYPICAL HEAVY SECTIONS

welding together combinations of hot rolled long products, hot rolled flat products or cold rolled flat products.

2.3.9 *Cold Formed Sections* — Cold formed long products having various cross-sectional shapes similar to the either open or with edges abutting, constant along their length.

NOTE — Cold formed sections are made from coated or uncoated hot or cold rolled flat products whose thicknesses are only slightly modified by the cold forming processes (for example profiling, drawing, press forming, flanging, etc). They comprise of:

a) General purpose cold formed sections, for example L, U, C, Z, Ω (Omega) sections;
b) Products for general applications including cold formed sheet piling (*see* **2.3.7.2**), crash barriers, building frames, door frames, lorry and wagon chassis.

2.4 Terms and Definitions — Process Related

2.4.1 *Baking* — Heat treatment permitting the release of hydrogen absorbed in a ferrous product without modifying its structure.

NOTE — This treatment is generally carried out following an electrolytic plating or pickling, or a welding operation.

2.4.2 *Base Size (Common Drawn Size)* — The intermediate size in which wire is annealed or patented before final drawing; in the case of drawn galvanized or drawn tinned or drawn tinned wire, the size in which it is galvanized or tinned.

NOTE — Also used for the finished product to denote the ranges of sizes sold at minimum price.

2.4.3 *Cast (Heat or Melt)* — Usually the product of a single furnace charge. Sometimes the furnace contents are tapped into two or more ladles when the product of each ladle may be called a separate cast.

2.4.4 *Chipping* — Removing surface defects by manual or pneumatic chisel.

2.4.5 *Coating*

a) Covering the wire with a film to act as vehicle for the lubricant used in drawing, for example, hydrated lime or sull.
b) Covering the surface of wire with protective film, for example, zinc, tin, etc.

2.4.6 *Cogging (Roughing)* — The reducing operation in hot working an ingot into a billet with a forging hammer or a forging press.

2.4.7 *Coiling* — The process of laying or winding the product (usually wire rods and wires) in the form of coils

2.4.8 *Cold Drawing (Drawing, Bright Drawing)* — Reducing the cross-sectional area by pulling, when cold, through a die. The process produces a bright surface on the material.

2.4.9 *Controlled Coiling* — Coiling from the final hot forming (rolling, forging, etc) or heat treatment operation in a predetermined pattern to control camber, prevent flaking, reduce scaling, improve properties, etc.

2.4.10 *Cropping (Cutting, Shearing)* — Shearing off discard from the ends of an ingot or bloom or forged products prior to further working. Ends discard shearing of semi-finished or finished products is also called cropping.

2.4.11 *Cross Rolling* — Rolling in the direction transverse to the longitudinal axis of the ingot or slab, as in the production of plate or sheet.

2.4.12 *Cut Length* — Wire straightened and cut to a given length.

2.4.13 *Descaling* — Removal of surface scale from a hot worked or heat treated product by pickling, shot blasting, etc. Also removal of scale during product hot working by the application of water, coal dust, brushwood, oil, etc.

2.4.14 *Deseaming (Scarfing)* — The removal of surface defects from ingots or semi-finished products by an oxy-gas flame.

2.4.15 *Die* — A tool having a prepared hole, for cold drawing.

2.4.16 *Discard* — Those portions corresponding to the top and bottom of the ingot, which are removed to ensure that the reminder of the material is of satisfactory quality. Also defective material produced in rolling or forging, to be cut off from one or both ends of the semi-finished product.

2.4.17 *Draft (or Draught)* — The amount of reduction in the cross-sectional areas during drawing.

2.4.18 *Dressing* — Removing surface defects from an ingot, bloom or slab by chipping, deseaming or other methods.

2.4.19 *Edging* — The application of rolls to the edges of a rectangular section, for example, slab, plate, sheet and flat, with the object of controlling width and giving a smooth edge during the rolling process.

2.4.20 *Electrogalvanizing* — The electroplating of zinc or zinc alloys upon iron or steel.

2.4.21 *Electrotinning* — Tin coating by electrodeposition.

2.4.22 *Exact Length* — Material cut to specified length and agreed tolerance.

2.4.23 *Finished Products* — Rolled or forged products whose transformation in an iron and steel plant is completed. Their cross-section is uniform and is often defined by a standard which fixes the ranges of nominal dimensions as well as the tolerance of form and dimensions. The outline of the cross-section and the surface finish is such that quite often the user has only cut to the required dimensions.

2.4.24 *Finishing* — The later stages of a rolling process wherein the material is brought to the desired shape and dimensions. It also refers to the process of cutting to length, drilling, machining, straightening, dressing, oiling, etc, of the finished products.

2.4.25 *Finishing Temperature* — The temperature at which hot working is completed.

2.4.26 *Galvanizing* — Process of depositing zinc on a metallic surface.

2.4.27 *Gauge* — The thickness of sheet or diameter of wire. The various standards are arbitrary and differ with regard to ferrous and nonferrous products as well as sheet and wire.

2.4.28 *Ground Finish* — Wire or rod bright finished by grinding to given limits.

2.4.29 *Hot Bed* — A cooling bank for accommodating hot-rolled products to minimize distortion during subsequent cooling.

2.4.30 *Hot-Dip Galvanizing* — Coating with zinc by immersion in a bath of molten zinc.

2.4.31 *Hot-Dip Tinning* — Coating with tin by immersion in a bath of molten tin.

2.4.32 *Liming* — The application of a film of hydrated lime to pickled material prior to drawing, to neutralize any traces of acid and to protect from rusting.

2.4.33 *Machine Straightening* — Straightening by reeling, spinning or other mechanical means**.**

2.4.34 *Mangling* — Flattening of plates, hot or cold, by passing through a multi-roll straightening machine.

2.4.35 *Oiled Finish* — Material immersed or otherwise coated with oil after cold working or annealing.

2.4.36 *Oiling* — Coating with oil as a temporary rust preventive.

2.4.37 *Patenting* — In wire making, a heat treatment applied to medium- or high-carbon steel before drawing of wire or between drafts. This process consists of heating to a temperature above the transformation range and then cooling to a temperature below Ae_1 in air or in a bath of molten lead or salt.

2.4.38 *Pickling* — The removal of scale by chemical or electrochemical treatment with dilute acids or other chemicals followed by washing.

2.4.39 *Planishing* — Producing a smooth finish on metal by a rapid succession of blows delivered by highly polished dies or by a hammer designed for the purpose, or by rolling in a planishing mill.

2.4.40 *Plate (Wire Drawers)* — A steel tool containing a series of tapered hole through which wire is drawn.

2.4.41 *Polishing* — Producing a scratch free or mirror like finish.

2.4.42 *Precision Ground* — Material ground to very accurate dimensions.

2.4.43 *Punch* — A tapered tool used by wire drawers for imparting the correct contour and size to the hole in a wire drawers plate or wortle.

2.4.44 *Ragging* — A series of grooves usually horizontal, made in the surface of a roll in order to assist the roll to bite the steel and to prevent skidding between the roll and the work. Ragging is usually found in roughing and forming passes.

2.4.45 *Reeling* — Straightening (and planishing) a round bar by feeding it between contoured steel rolls in a direction approximately parallel to the principal axes of the rolls.

2.4.46 *Reheating* — Heating of steel to a uniform temperature in readiness for hot working.

2.4.47 *Roll Straightening* — The straightening of metal stock of various shapes by passing it through a series of staggered rolls, the rolls usually being in horizontal and vertical planes, or by reeling in two-roll straightening machines.

2.4.48 *Rolling* — The shaping of metal by pressing it between two rotating rolls.

2.4.49 *Roll Pass (Pass)* — Openings of definite shapes formed between a set of rolls through which hot steel passes for taking up the given shape or undergoing a desired amount of reduction in sectional area. This term also applies to a single passage through a pair of rolls for the purpose of altering the shape and/or reducing the cross-sectional area.

2.4.50 *Shearing* — This term is often used for cropping, which is done with shears. Also cutting approximately given lengths not within any given tolerance.

2.4.51 *Spinning* — Straightening by feeding through rotating rollers or dies. The bar or wire does not rotate.

2.4.52 *Straightening* — Straightening either by machine or hand.

2.4.53 *Tolerance (Rolling Margin)* — The permitted deviation from a specified dimension or weight usually expressed as plus minus on that quantity.

2.4.54 *Swift* — A rotating devices on which the coils of wires are placed for unwinding.

2.4.55 *Tagging (Pointing)* — Tapering one ends of a rod or wire before drawing.

2.4.56 *Tolerance (Rolling Margin)* — The permitted deviation from a specified dimension or weight usually expressed as plus or minus on that quantity.

2.4.57 *Turned Finish* — The bright finish on a bar produced by turning.

2.4.58 *Universal Rolling* — Rolling in a universal mill provided with edging rolls for obtaining closer width tolerance and better edges in plates and slabs.

2.4.59 *Wap* — The single turn in a coil.

2.4.60 *Wash Heating (Sweating)* — The soaking of an ingot or part cogged ingot (after limited rolling) at high temperature under oxidizing conditions so that surface melts and runs off as fluid slag. Surface defects of an ingot or partly cogged ingot may be removed in this way.

2.4.61 *Wortle* — A hard plate for wire drawing containing series of straight lines.

2.4.62 *Wire Drawing* — Reducing cross-sectional area of a wire by pulling through a die or plate (*see* **2.4.8** and **2.4.39**).

2.5 Terms and Definitions — Defects

2.5.1 *Blister* — A small raised area on the surface resulting from the expansion of gas concentrated at a sub-surface inclusion or other imperfections. May occur as isolated spots, but often found in longitudinal streaks.

2.5.2 *Broken Back (Cracked Back)* — A band of transverse cracks along a drawn wire.

2.5.3 *Broken Corners* — Wide but usually short cracks across the edges of semi-finished products (such as blooms, billets and slabs).

2.5.4 *Broken Edges* — Broken edges occurring during hot rolling, caused by overheating or burning.

2.5.5 *Burr* — The sharp fringe of metal left on a sheared or saw-cut bottom edge.

2.5.6 *Camber* — The curvature observed in long products caused by differential cooling or faulty setting of the rolls. It is measured by the maximum deviation of the middle region from the straight line joining the ends.

2.5.7 *Checked Edges* — Cracked edges in sheet bars and strips occurring during hot rolling.

2.5.8 *Chill Crack (Fire Cracks)* — Marks on a rolled surface resulting from cracks in the surface of a roll used for hot rolling. A particular form of roll mark, surface cracks, found on rolls is usually caused by alternate heating and cooling or by overheating of the rolls in service in which case it is called a fire crack.

2.5.9 *Clink* — Internal rupture produced by too rapid heating of the cold material in the soaking pit or reheating furnace, or external rupture caused by the rapid chilling of the surface of the as-cast ingot or reheated material. In the first case a high tensile stress is developed internally, so that the material fractures internally; in the second case, the formation of a high tensile stress in the outer skin produces external cracking.

2.5.10 *Cracked Edges* — Cracks across the edges (that is, at right angles to the direction of rolling) of rolled products. The term broken corners is used in connection with large sections, for example, blooms, billets and slabs.

2.5.11 *Cuppiness or Cupping* — An internal transverse crack in wire, which may eventually, results in fracture of the cup and cone type. It may be caused by excessive cold work (over drawing) or segregation where the harder centre is less ductile than the surface.

2.5.12 *Decarburization* — Depletion of carbon from the surface layer of a ferrous product. This depletion may be either partial (partial decarburization) or nominally complete (complete decarburization).

The sum of the two types of decarburization (partial and complete) is termed total decarburization.

2.5.13 *Die Mark (Die, Score, Die Scratch)* — Scratch marks made during drawing due to poor condition of dies or gritty material being drawn in the die along with the wire.

2.5.14 *Drawn-in Scale* — Local patches of scale, which the pickling has failed to remove, and which have consequently become embedded in the surface by cold drawing.

2.5.15 *Fash (Burr, Flash)* — Sharp and jagged edges left after shearing or sawing.

2.5.16 *Fin (Overfill, Flash)* — A protruding rib of metal running longitudinally along a rolled product, as results from overfilling a pass.

2.5.17 *Fish Tail* — The V-shaped cavity which may develop at the end of the piece during hot rolling.

2.5.18 *Guide Marks* — Scoring of the steel caused by defective or badly set guides, or by extraneous material adhering to the guides. Guide marks are always straight and easy to recognize if put in during the final pass, but may be mistaken for splits or seams if put in during the earlier passes.

2.5.19 *Hair Line Cracks (Hair Cracks)* — Internal ruptures in steel caused by stresses which probably arise from the combination of several factors, such as volume changes due to transformation, brittleness due to the presence of hydrogen, and the arrangement of the microstructure, resulting from hot working. The size of such ruptures may vary considerably, but they are usually comparatively short in length when viewed on a surface cut at right angles to the plane of defect, and generally are so fine that they cannot be discerned other than after etching or by magnetic crack detection.

2.5.19.1 *Snowflakes* — When hairline cracks are exposed by fracturing, they appear as bright crystalline areas of almost circular form, sometimes known as snowflakes.

2.5.20 *Heat Waste (Fire Waste)* — The loss of material by scaling in a reheating or hot-working process.

2.5.21 *Inclusions* — Particles of oxides, sulphides, silicates, refractories, etc, embedded in the metal. These are products of oxidation.

2.5.22 *Ingotism* — The extremely coarse dendritic structure which exists in unannealed ingots and castings. It is a term which is also used to describe microstructure of forgings which show coarse dendritic pattern. Pattern of ingot structure is observed in sulphur prints of blooms and billets.

2.5.23 *Laminations* — A defect in rolled materials, characterized by a tendency to split into layers along the direction of rolling usually due to the presence of non-metallic inclusions or other discontinuity in the steel.

2.5.24 *Laps* — Oxidized folds in the skin of the product produced during rolling, which may be difficult to distinguish superficially from splits arising from longitudinal ingot cracks. Broadly speaking, in cross-section, splits and seams tend to run at right angles to the surface, whereas laps usually run at a relatively small angle to the surface.

Further rolling of lapped material often results in shelliness, owing to portions of the lap breaking away.

2.5.25 *Overheating* — Heating to such a high temperature that an undesirable coarse grained structure is produced. Severe overheating may result in the properties being permanently impaired.

2.5.26 *Over-Pickled* — Pickled longer than necessary resulting in pronounced chemical attack causing pitting and roughness on the surface.

2.5.27 *Phosphide Streak* — An elongated area of phosphides, which is revealed, on etching.

2.5.28 *Pipe (Contraction Cavity, Shrinkage Cavity)* — An axial cavity caused by contraction during solidification of an ingot. Also the defect arising from the axial cavity in the semi-finished or finished products. It may also refer to tubular products.

2.5.29 *Pulls* — Characteristically forked or Y-shaped defects, produced from transverse ingot cracks which have elongated and forked in the direction of rolling.

2.5.30 *Pitted Surface* — A surface containing small pits or depression resulting from unsatisfactory processing.

2.5.31 *Reed* — A internal discontinuity originating from a subcutaneous blowhole which has become oxidized and has been elongated during rolling.

2.5.32 *Rod Crack* — A longitudinal defect in wire rod or wire due to unsatisfactory rolling technique.

2.5.33 *Rokes* — A term which should be restricted to isolated deep seams having their origin in large blowholes or in large non-metallic inclusions, and which are associated with oxide and decarburization.

2.5.34 *Roll Marks* — Roll marks produced in the finishing mill passes are observable at regular intervals along the length of the product. They may arise from damaged rolls or from pieces of steel adhering to the rolls.

2.5.35 *Rolled Rolled-in Scale* — Patches of scale which have not been satisfactorily removed during rolling or forging, and which have persisted throughout to the final product.

2.5.36 *Running Out (Non-Sizing)* — An excessive progressive increase in the size of wire during drawing, due to abnormal wear of the die.

2.5.37 *Scab* — Irregular shaped patches of metal on ingot surface arising from cavities in mould walls or caused by loosely adhering layers of metal.

2.5.38 *Seams* — Numerous shallow grooves or striations, most obvious when the piece is up-ended, cross-cut or pickled. They are generally formed by the elongation during rolling of oxidized surface or sub-surface blowholes present in the ingot. They may also arise from a badly rippled surface or from recurrent teeming laps.

This defect is sometimes known as ‘reeds’ and ‘rokes’.

2.5.39 *Segregation* — A non-uniform distribution of some constituents and/or impurities in a cast product characterized by the mode of solidification of alloys. Segregation usually persists through subsequent hot and cold working. Generally, the concentration of low melting point constituents tend to be higher in the centre than the surface. Sometimes the reverse of this phenomenon takes place and is known as inverse segregation.

2.5.40 *Shells* — A flaky surface appearance resulting from ingot defects ‘double skin’, ‘splash’, ‘flash’, ‘fin’, or ‘scab’.

Shells may also arise during rolling from the exposure and oxidation of subcutaneous blowholes in the soaking pits, or as a result of faulty manipulation.

2.5.41 *Snarl* — A kink, which has been drawn tight in a wire.

2.5.42 *Sulling (Rusting)* — Formation of a thin coating of hydrated oxide of iron on a coil or wire or rod obtained by keeping the coil wet spraying water in fine jets after pickling.

2.5.43 *Tramlines* — An overfill or lap usually occurring in parallel pairs of lines. Long straight marks due to drawn out inclusion on rolled sheet are also called tramlines.

2.5.44 *Underfilled* — A condition produced during rolling when less metal is present than is required to give the desired section, the deficiency of metal giving rise to an obviously ‘lean’ and sometimes ‘raw’ place in the section during the final pass.

Underfilling in the earlier passes, causing severe elongation without roll contact, and particularly when the steel has been standing at rolling heat for an undue length of time, may result in a spongy or ‘honeycomb’ structure which on subsequent rolling with roll contact produces a series of small ‘fish-scale’ shells.

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